**Title**

The use of odd random phase electrochemical impedance spectroscopy to study corrosion inhibition by active protective lithium-based coatings

**Abstract**

Electrochemical impedance spectroscopy (EIS) has proven to be a powerful technique to study electrochemical systems. However, classical EIS measurements are unable to describe the initial, rapidly evolving stages of electrochemical processes since it requires the conditions of causality, linearity and stationarity (time-invariance) to be fulfilled. Odd random phase electrochemical impedance spectroscopy (ORP-EIS) is a multisine approach providing information about these three conditions and could therefore provide a solution for this problem. Lithium-carbonate inhibitor technology is used here as an example of a fast-working protective process. A comparison is made between a model organic coating with and without impregnated lithium-carbonate pigments regarding the data quality and fitting reliability of ORP-EIS measurements. It can be concluded that ORP-EIS can successfully describe the initial, rapidly evolving stages of electrochemical processes, by providing both qualitative and quantitative information about the correctness of the electrochemical data and ensuring the reliability of the fitting, which is crucial to describe electrochemical processes.

**Keywords**

corrosion, odd random phase EIS, inhibitor, reliability, EIS modeling